

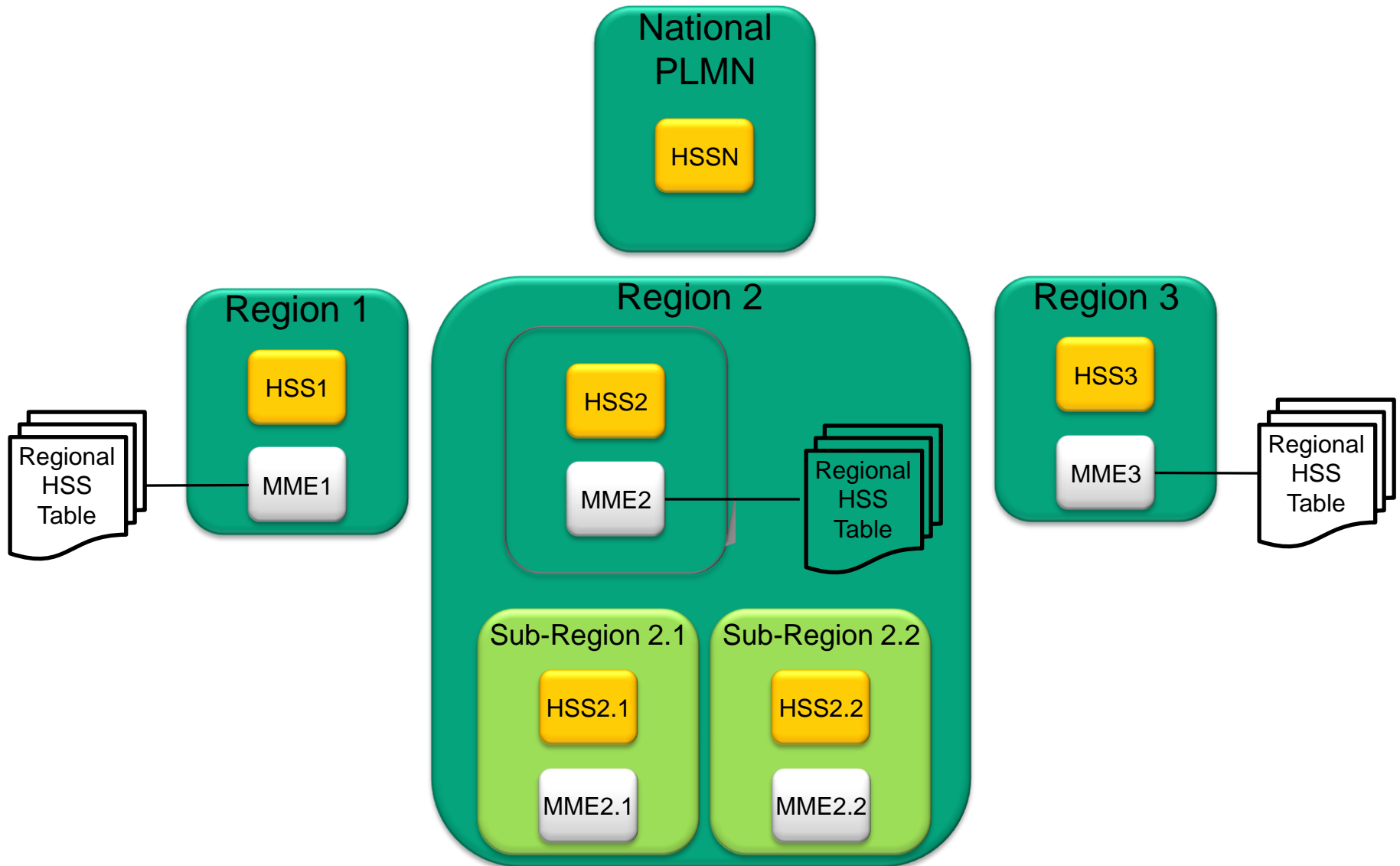


700 MHz Public Safety Broadband Network Architecture, Governance and Evolving Policy November 12, 2010

Harris Corporation
Public Safety and Professional Communications

-
- Describe a regional architecture that provides for flexible licensing of 700MHz Public Safety spectrum
 - Enable nation-wide roaming using the “Home Routed” and “Local Breakout” models in support of variety of Public Safety application sets

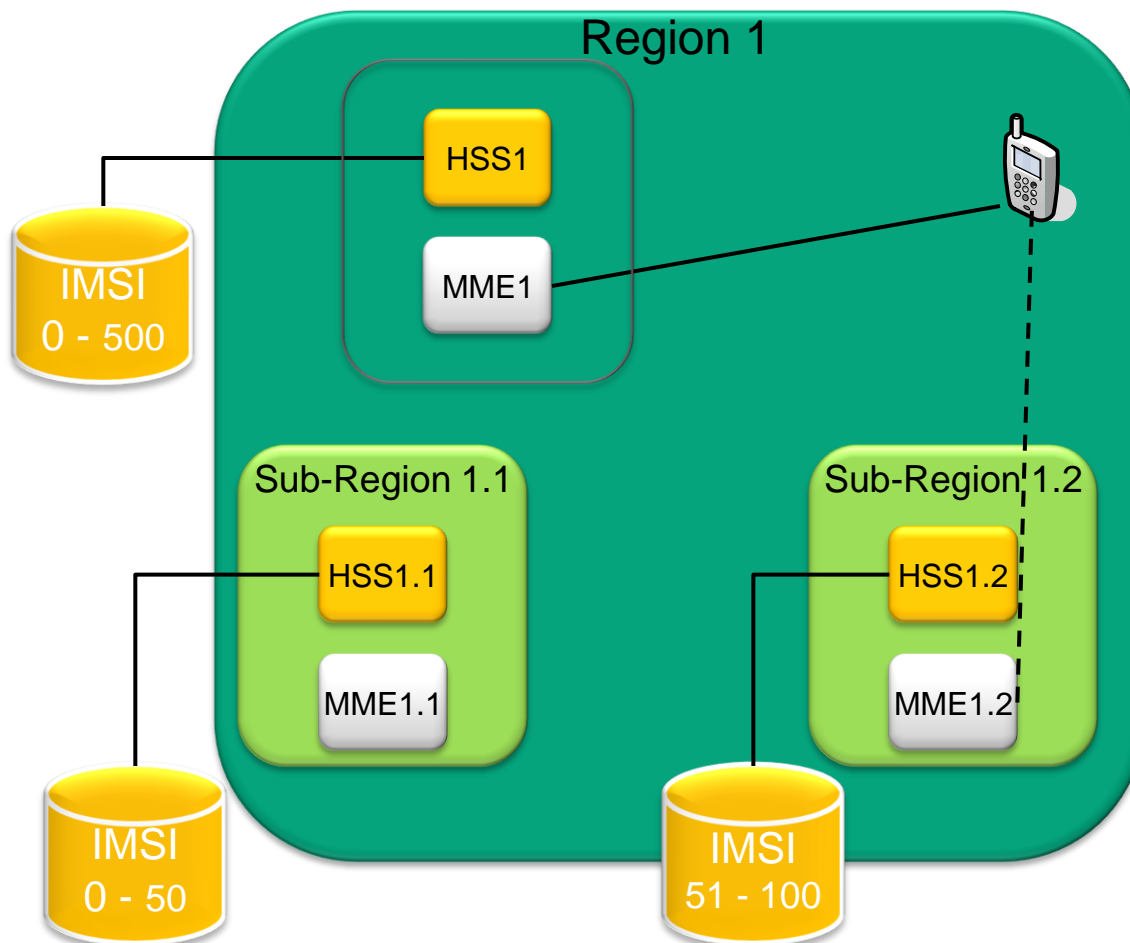
- Applications typically lend themselves to one of the two LTE roaming architectures
- “Home Routed” roaming architecture
 - Public Safety applications that may require home access
 - Localized NCIC lookup
 - Incident Command System
- “Local Breakout” roaming architecture
 - Non-critical applications
 - Internet, email, browser
 - Public Safety applications that may not require home access
 - Localized streaming video



- “Regional Core Networks” at the level of States
 - Regional Core may contain sub-regional cores
 - Allows for regional flexibility

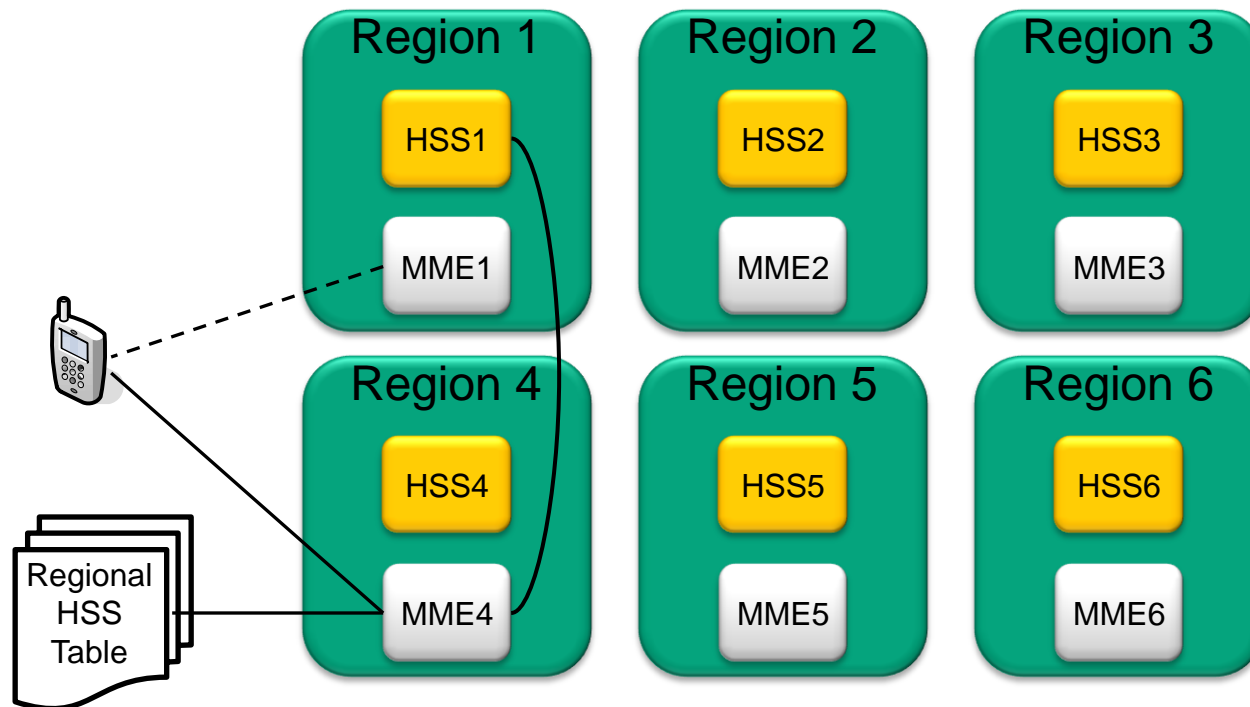
- Each Region is assigned a PLMN ID
 - Regional MME’s contain the identity of all of the regional HSS’s
 - Enable inter-state roaming

- There is optionally a National PLMN ID to allow for nation-wide roaming, instituting a National PLMN ID would be preferential



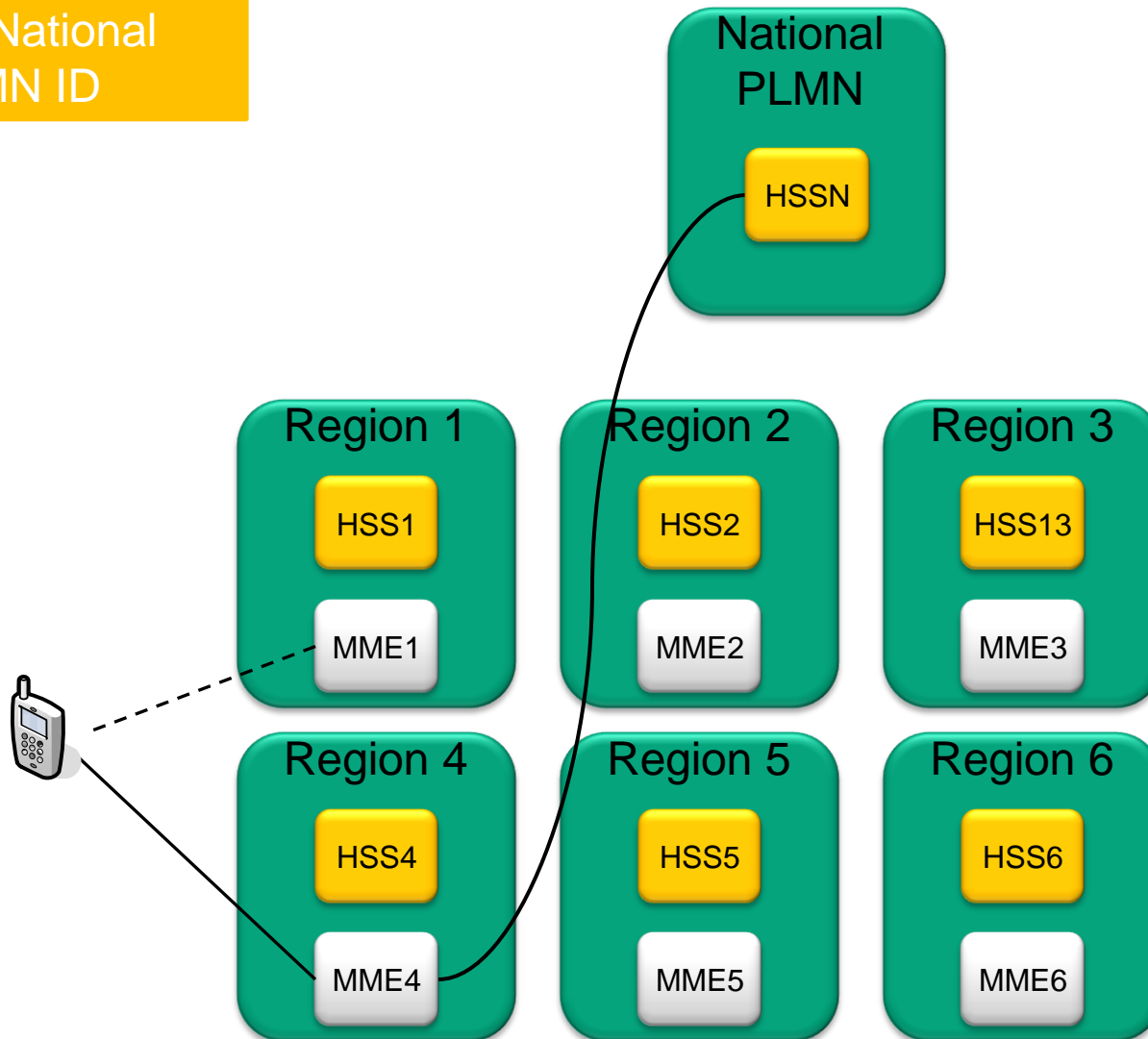
- Each “Region” requires a “Master” HSS
 - Each Region has a single PLMN-ID
 - Each PLMN-ID serves one or more HSS’s
- “Master” HSS contains user authentication and provisioning information for all users in region
 - Roaming anchor for inter-regional roaming
- Allow “Distributed” HSS’s which contain information for a subset of users homed with the “Distributed” core
 - Provides regional flexibility and redundancy

Without using
National PLMN ID



- Each MME contains a table of all Regional identities
- Roaming users register with visited network's MME
- Visited MME contacts Home HSS for authentication
- Inter-Regional roaming agreements take effect
- Most roaming occurs between adjacent Regions
- **Adjacent roaming minimizes backhaul and access requirements**

Using National
PLMN ID



- RANs broadcast Regional PLMN ID and National PLMN ID
- Users could have National PLMN ID as their H-PLMN
- “Local Breakout” traffic may need to backhaul to the National core
- “Home Routed” traffic may need to backhaul through the National core back to the home core
- **Use of National PLMN ID for roaming requires substantial backhaul to the National Network**

Appendix



700 MHz Public Safety Broadband Network Architecture, Governance and Evolving Policy October 15, 2010

Dr. Dennis Martinez
V.P. Broadband and Cellular Solutions
Public Safety and Professional Communications
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- Market Conditions
- Ongoing regulatory matters
- Discussion
 - System Architecture/Technology
 - Governance Structure
 - Public Policy

Public Safety 700 MHz Broadband Market Launch Conditions Now Exist



Spectrum

- FCC Granted 21 Licenses – Construction will begin late 2010 / early 2011
- 23+ Applications pending PN
- D-Block resolution pending

Funding

- NTIA opened a special round of BTOP grant eligibility – awarded \$382M worth of grants
- Multiple congressional initiatives to create funding pools

Technology

- LTE as the Technology Standard
- NIST will oversee a compliance/interoperability program similar to P25 CAP

User Needs

- Public Safety organizations continue to deploy bandwidth intensive applications
- Public Safety organizations are including broadband requirements in many RFPs

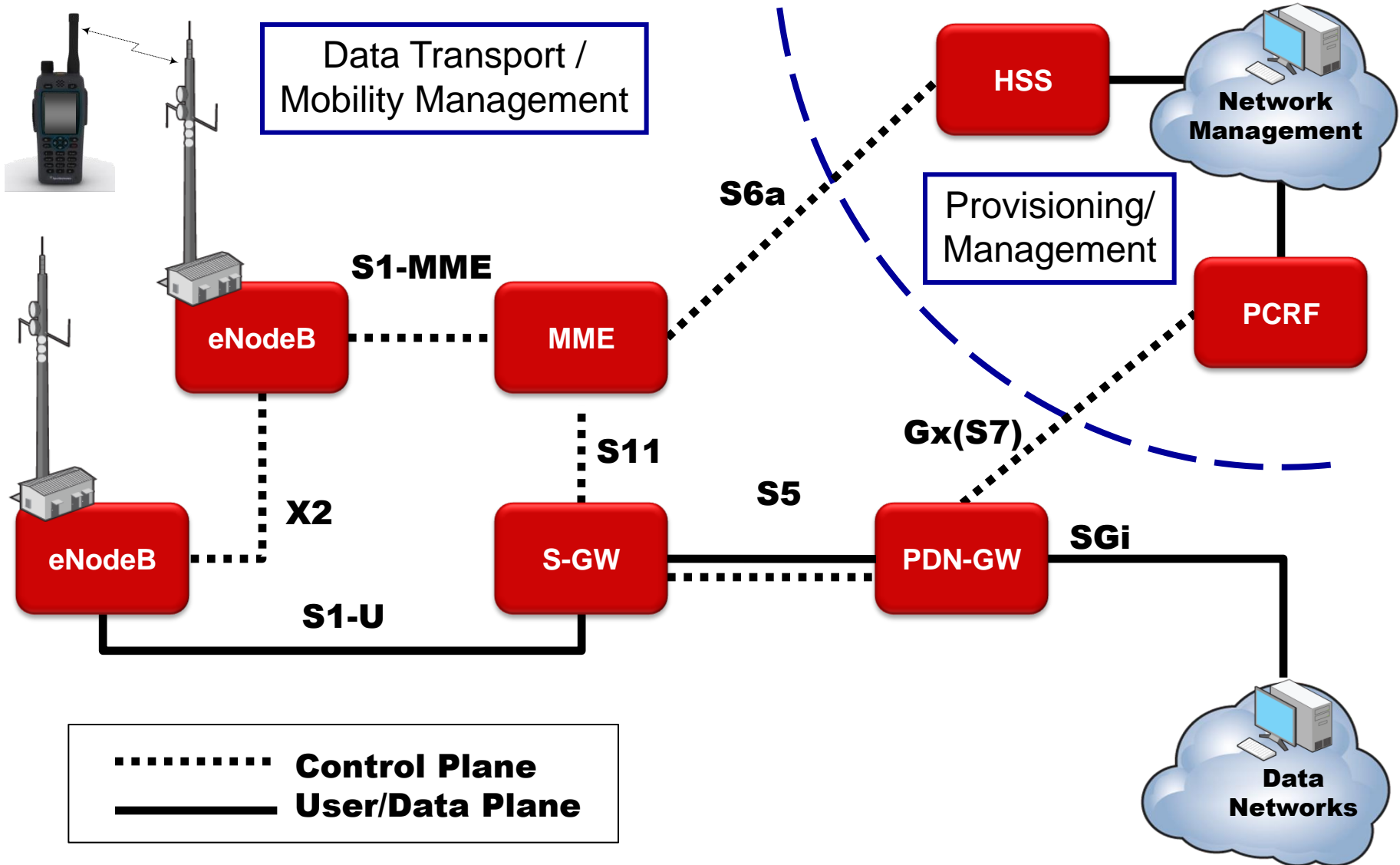
- Spectrum/Regulatory
 - Finalized rule making
 - Resolution of D-Block issue
 - Development of governance structure(s)
- Architecture/Technology - Establishing a notional architecture that:
 - Accommodates multiple business models
 - Private Networks – Traditional PS build, own, operate
 - Leveraged – PS RAN on Carrier Core
 - Carrier – Fully outsourced Core/RAN
 - Achieves interoperability mandate
 - Leads to a workable long-term Operations and Maintenance (OAM) implementation
 - Allows for optimization based on localized jurisdictional needs
 - Meets Public Safety standards for service availability
- Funding
 - Continued legislative initiatives to create funding
 - State & Local budgeting processes

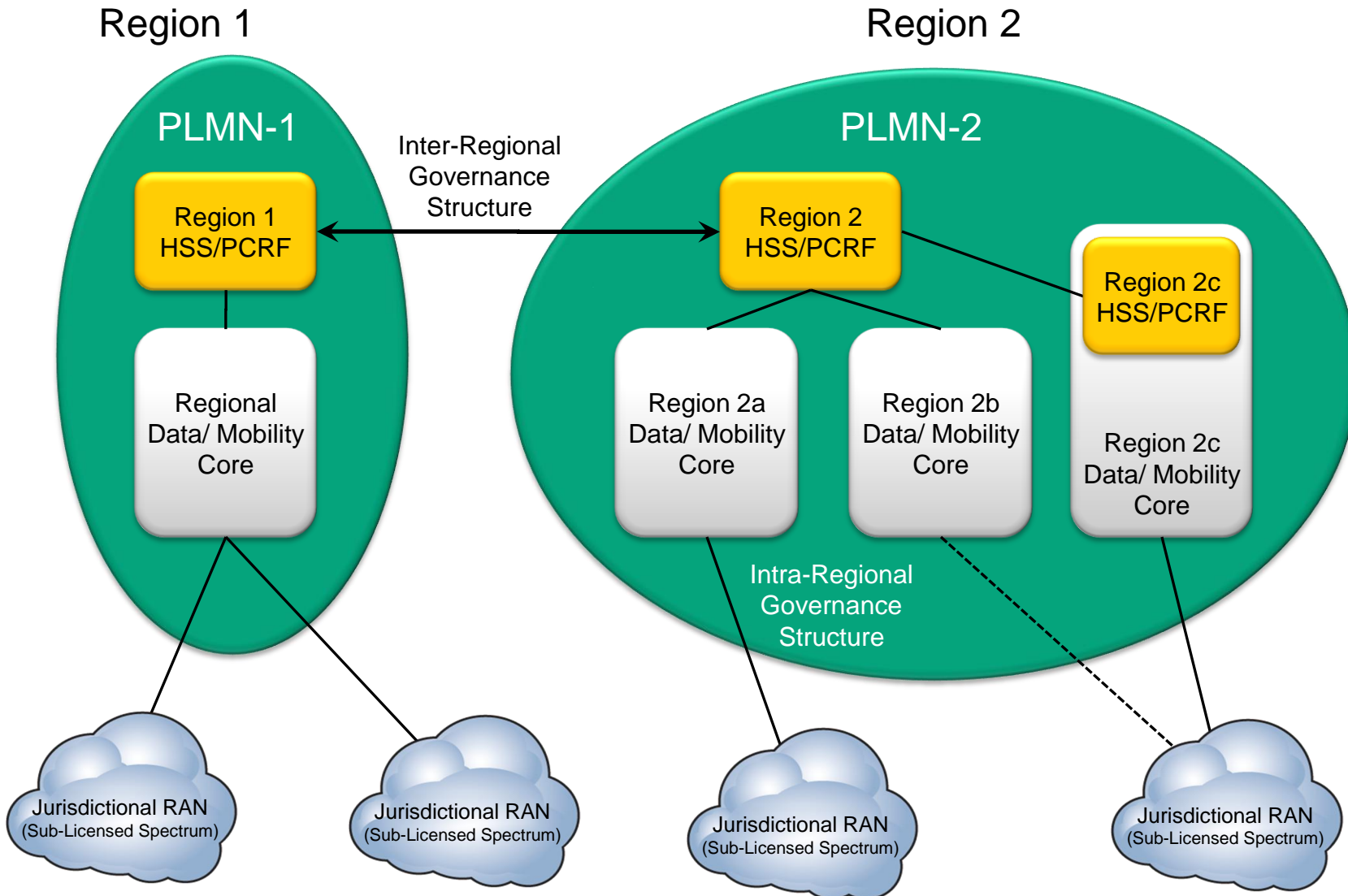
- Need to identify and de-couple policy (spectrum licensing) technology/architecture and governance issues
- Spectrum sub-licensing should focus on the RAN without being encumbered by how the Core is implemented
 - Key Issues:
 - Overlapping coverage
 - Interoperability and co-existence
- Technology/Architecture
 - Notional architecture should consist of multiple “Regional Core Networks”
 - Permit and enable flexible interconnection of RANs to Cores
- Governance
 - Identify decision points that require inter vs. intra regional governance

- “Provisioning and Management”
 - Elements: HSS and PCRF
 - Contains user profiles, authentication information, etc.
 - Contains information to setup user bearers
 - Requires centralized management for roaming (nation-wide interoperability)

- “Data Plane/Mobility Management”
 - Elements: MME, S-GW, PDN-GW
 - Backhaul considerations drive proximity to RAN
 - User plane high bandwidth requirements: 50-100Mbps/site
 - User mobility management
 - Often best geographically distributed throughout the network

LTE Core Network





Consideration for Regional “Centralized Cores”



- Each “Region” requires a “Master” HSS
 - Each Region has a single PLMN-ID
 - Each PLMN-ID serves one or more HSS’s
- “Master” HSS contains user authentication and provisioning information for all users in region
- “Master” HSS is defined as “Roaming” HSS for adjacent regional users

- Each region can define an architecture for the “Regional Core”
- Each region requires a single “Master” HSS
- The core can be distributed:
 - Region can contain many S-GW, PDN-GW, and MME
 - Region MAY choose to have distributed local HSS for sub-region traffic
 - Must “roll up” to the “Master” HSS
- Some regions may choose to have a single core for the whole region
- The “Master” HSS contains information about other core elements for each user (i.e. PDN-GW)
- Regional cores can be privately owned by Public Safety jurisdictions or affiliated with a public cellular operator

- Management of a “Master” HSS is best put within an established governance framework (e.g. States)

- Roles of “Master” HSS management
 - Functional/Technical Requirements
 - Define/Setup Users
 - Allocate user priorities and configure bearer services
 - Management Requirements
 - Staff to administer system/users
 - Staff to monitor/manage regional network

- UE – User Equipment
- eNodeB – Evolved NodeB provides radio access to the LTE network
- MME – Mobility Management Entity implements handover control and authentication functions
- S-GW – Serving Gateway is the anchor point for user equipment and mobility functions – this includes managing and storage of UE contexts
- PDN-GW – Packet Data Network Gateway provides connectivity between the UEs and the external Packet Data Network – this includes policy enforcement and packet filtering
- HSS – Home Subscriber Server implements the Home Location Register (HLR) and Authentication Center (AuC) functions
- PCRF – Policy and Charging Rules Function administers and allocates services to UEs – this includes priority, Quality of Service (QoS) and Type of Service